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ABSTRACT

A program of computer-assisted instruction (CAI), using the Radio Shack TRS-80, was tried at Eagleville (Pennsylvania) Hospital and Training Center for adult alcoholics and drug abusers. Most of the students using the program had extremely low reading levels and little success with schools; a majority had been in trouble with the law. It was hoped that CAI would engage the students in meaningful learning, free teachers for more individualized help for students, and set up an atmosphere of success in education for the students. A process evaluation of the program showed that some of these objectives had been met; however, there were problems in some areas. In general, most of the students reported that they enjoyed the use of the computers, and that they were learning from the experience. Teachers said about half the students appeared to be benefitting. Although it could not be documented, it appeared likely that the success students had experienced in their limited exposure to the CAI could carry over in future training endeavors. Problems encountered in implementing the program included software that was inappropriate for age level of the students, or had too many programming errors; equipment malfunctions and inadequacy of the cassette player/recorder selected; and security problems that caused the computers to be installed in three different locations and increased the teachers' work load. As a result of the process evaluation, it was concluded that the minicomputers provide a very useful adjunct to the educational program at Eagleville, but that they are not being used to their full potential. Recommendations were made for hardware and software changes, a better environment, and staffing possibilities. (KC)

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AN EVALUATION OF

COMPUTERIZED INSTRUCTION FOR INSTITUTIONALIZED ADULT STUDENTS,

ADDICTS AND ALCOHOLICS

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September 14, 1981

AN EVALUATION OF
COMPUTERIZED INSTRUCTION FOR INSTITUTIONALIZED ADULT STUDENTS,
ADDICTS AND ALCOHOLICS

I. INTRODUCTION

The evaluation design for this project originally included both a process and an outcome study. Our goal was to first assess the potential of Computer Assisted Instruction (CAI) to augment the teaching staff in the EHRC Education Department, and then to measure the cognitive gains made by students who used them. The process evaluation has been carried out in detail, and is reported below. It became clear during the very early stage of the project that the outcome study, employing an uncomplicated experimental design, would be neither appropriate, feasible, nor in the best interest of our students. Among the circumstances and factors which led to this realization:

1. Initial problems with loading some of the programmed tapes occasionally precluded offering lessons according to a fixed schedule.
2. Because of treatment priorities, the Education Department was not able to schedule sessions with the students on a consistent basis.
3. Use of the computers was prized by many students; maintaining a control group that was denied access would not have been fair.
4. The relatively short time spent learning at the machines made it unlikely that significant educational gains directly attributable to CAI would be observed.
5. The anxiety introduced by pre and post testing would potentially offset many benefits which CAI offered.

Despite the deletion of this aspect of the design, information accumulated for evaluation was considerable, and can be useful in modifying both the implementation of CAI in particular, and EHRC's adult education program in general.

II. IMPLEMENTATION

A. Purchase of Equipment and Software

Following the grant award on July 1, 1980, Mr. Derry Antes of EHRC's Data Processing Department checked whether any changes in the minicomputer market would make a reconsideration of our earlier equipment recommendation advisable. A cost analysis and review of the literature indicated that the TRS-80 Model I (level II) was the most appropriate for our needs, both in terms of cost, capacity, and available software. Following formal recommendations made on July 24, 1980, three minicomputers (consisting of a video display, keyboard/processor, and cassette tape unit) were ordered from a Radio Shack distributor at a reduced price. Also ordered was one Quick Printer to provide hardcopy program listings and records.

The equipment and the first educational tapes arrived in September. Mr. Mark Smiley of the Research Department was put in charge of familiarization with the equipment and learning the version of BASIC language which the computer supported. He then conducted a preliminary training session with staff from the Education and Research Departments in how to assemble and activate the computer, how to load preprogrammed cassettes, and how to perform other rudimentary operations.

B. Tape Prescreening and Use

As each new tape was received, it was previewed by teaching staff. Often this process revealed bugs in the software, and sometimes the tape would not

load at all. Minor difficulties were corrected by Mr. Malcolm West of the Research Department, while those requiring major effort were returned to the Tandy Corporation for repair or replacement. Some tapes were found to be technically intact but were grossly inappropriate because they were geared to children rather than adult learners. (The issue of software quality will be discussed in greater detail in a later section.)

After the tapes were previewed and corrected, they were made available for student use with a teacher available to help initiate the program and answer questions. Frequently teachers would note additional problems that had escaped the prescreening, or would have ideas about ways in which the ease of use could be enhanced. The tape would then be corrected again if necessary. Only after a tape had been subject to this procedure would it be ready for general use.

C. Staff Training

An introductory course on BASIC language programming and minicomputer operation was designed for training the Education and Research Departments. The course consisted of four weekly two-hour sessions and included instruction, hands-on experience, and homework assignments. The course was first offered in November 1980 and was open to all Eagleville staff. Surprisingly, enrollment far exceeded class size capacity, making it necessary to schedule a second course for February 1981. After taking the course, several teachers and others were able to do some programming on their own and to correct problems that occurred with the prepackaged software.

In additon to the formal staff training, members of the Research Department have been available to provide consultation and more specialized training as needed to solve particular problems or to debug or enhance programs.

D. Tape Modification

One major modification process was to alter the Synonyms and Antonyms tapes from the IQ Builders series. The purpose of the project was to provide greater ease of use, clearer display, and an integrated record keeping procedure. The following functions were performed:

1. The size of the characters used in the display were doubled so that students with poor eyesight or perceptual problems could more easily read what was printed.
2. The need for a student to strike the 'ENTER' key after each response was eliminated in order to reduce frustration, confusion, and delay.
3. The student's own response was displayed after each attempt. This process has been demonstrated to reinforce correct responses.
4. The scoring system was enhanced. A password-protected subprogram was added to permit the instructor to print the student's name, session number and exercise score after the student left.

Several games were also created or modified for use on the TRS-80. These games, similar to commercially available video games, are effective in motivating students to use the computers, in reducing anxiety, and for rewarding good performance.

Efforts are underway to create a new lower level math package, and to modify several other IQ Builder programs similarly to the way in which the Synonyms and Antonyms were adapted.

E. The Student Log

Beginning in December 1980, students were frequently asked to complete a log after participating in a CAI session. The log depicts the data and time of the session and the student's comments.

III. ASSESSMENT OF THE CAI SYSTEM AND SOFTWARE

A. Process

The student population at Eagleville is one with extreme educational deficits. The following statistics give a partial picture of why it is important to make the best possible use of their time here to help motivate them to continue to learn basic reading, writing, and problem solving skills.

- Fifteen percent read at the third grade level or less at admission.
- Fewer than 25% possess a high school diploma.
- Tested grade levels are invariably two to three years below the last grades students claim to have attended.
- Only 12% were employed prior to admission.
- Approximately 60% have been in legal trouble prior to admission.

With a weekly enrollment level of 110-125 students, the three full time teachers and 10-15 part time volunteers have an enormous task in providing the individual attention necessary to motivate and teach this population. It must be understood that these students have typically equated school with failure and education with anxiety. Therefore, the department has embraced new instructional techniques and available technologies to accomplish its goals.

The appeal of CAI is that it promises to help motivate reluctant or frightened students, to reduce teacher workload by acting as a substitute instructor, and to simultaneously instruct and monitor progress.

Its effectiveness and reliability in accomplishing these tasks were evaluated by performing the following tasks:

1. A review of the student comments.
2. Observation of a number of student CAI sessions. The type of lesson being covered, the student's apparent interest in the material, and any difficulties in operating the equipment or using the software were recorded.
3. Assessments of individual tapes by each of the full time teachers.
4. Interviews with each of the teachers at the end of the first year of the project. The interview covered:
   a. Overall usefulness of the TRS-80 System.
   b. Subject matter of the tapes.
   c. Instructional level.
   d. Problems involved in using the system.

B. Motivating Students

The students themselves found the experience of CAI both absorbing and enjoyable, with very few exceptions. In fact, more than half of the student comments refer specifically to being interested in the lessons and having fun while doing them.

Teacher observations confirm these comments, but with some reservations. One teacher remarked that only one-third or one-half of the students seemed comfortable, relaxed, and involved while using the CAI terminals. Another teacher felt that students at the extreme low end or high end of the cognitive scale would not find the experience beneficial. But, by and large, there was no doubt that for a significant proportion of students at Eagleville, the CAI program carries a strong incentive, offers opportunities for success, and provides a

pleasant educational experience. We expect, but cannot demonstrate, that the experience will be generalized to other learning situations.

C. Increasing Cognitive Abilities

Although more than 25% of the students reported in their comments that they had increased their level of knowledge by using CAI, such a claim would be extremely hard to document. It is unlikely that several lessons, either with a human or solid-state instructor, can begin to make up for years of difficulties. What is hoped is that students will change their attitudes about education, increase their self-confidence, and take a renewed interest in the learning process. The vocabulary drills can indeed help a student to learn new words, and the math problems can impart new skills or hone old ones. But the impact will be insignificant unless these students continue their education after leaving Eagleville.

D. What Students Benefit from the Experience?

Interviews with the teachers indicate that there are several factors which influence just how effective CAI is likely to be for a given student.

1. Reading Level - A student needs at least a third grade reading level to benefit from the program, and higher levels are desirable. One reason for this is that since the computer cannot communicate audibly, it must do so visually, and therefore relies extensively on written instructions. Another is that all of our software is geared to these or higher level students.
2. Test-Anxiety - The CAI works particularly well with students who are anxious about learning because they fear failure and therefore disapproval from instructors. The computer offers anonymity while still reporting the accuracy of the student's response.

3. Independence - Students who like to take charge of their own learning can profit from CAI once they know how to load an instructional tape because they select their own lessons and their own pace. However, with assistance from an instructor, the less self-directed students can still benefit.
4. Technical Aptitude - An undeniable appeal of CAI for many students, and one which should be exploited, is the remarkable gadgetry involved. Students who have an interest in technology soon become curious about how the computer works, and want to learn more about computing and programming. This can help to define areas for vocational rehabilitation.

E. The Hardware

The heart of the TRS-80, its microprocessor, is an amazing chip that is more than adequate for our purposes. It easily supports the type of programming suitable for our needs. The keyboard design is standard, and offers no particular problem. The display screen is roughly similar to a black and white television set and works very well for character display. Graphics on the TRS-80 are somewhat limited, though acceptable. Of course, a color display would be preferable, and the access to smaller units on the grid would allow less clumsy looking graphic depictions. Our system has the least expensive printer attachment. It is fast enough for our limited requirements, but prints out on aluminized paper in very small print. This combination makes printouts hard on the eyes at best, and sometimes illegible.

The most vexing problems result from the cassette player/recorder, which is used to store programs and data sets. When it is working at optimum it is very slow, especially in reading back data. Some of the more complicated lessons also take a long time to load, and therefore might cause the student

to be bored before even starting. But the real problem is that sometimes the recording and playback do not work at all, or work, but garble the programs. The volume control settings are extremely sensitive, but not consistent for each tape. And occasionally a malfunction in the recording process can cause the loss of an entire program, resulting in hours of programming down the drain. The audio cassette recorders used by the system are simply not up to the task to which they have been assigned.

F. Software

One general comment can be made about all of the available software. It is assumed that the user will be working at a grade level consistent with chronological age. Therefore lessons at the fifth grade level are tailored for twelve year olds, and often "talk down" to adult students. Unless there are programs available with which we are unfamiliar, it appears that there is a need for programs which teach adults skills at the lower academic levels.

The software frequently contained defects. Sometimes these were easily corrected by loading and listing the programs, and debugging them. At other times there were more complex programs with long assembly language algorithms and "security" coded subprograms that made debugging impossible except for Radio Shack technicians. Still other software simply would not load at all.

The level of sophistication of the educational software varies widely. Some tapes could have been written by a knowledgeable high school student; they are straightforward question and answer programs. Too often they show little regard for the convenience of the user, and ignore basic pedagogical techniques. While serviceable, these tapes required modification before they could be used.

The K-8 Math Programs are sophisticated and probably come very close to exploiting the machine's capacity as an instructor. Unfortunately, they

are somewhat difficult for a student to use without an instructor handy. But they have been very useful at times. One instructor wrote the following critique:

> "The novelty of this approach to drill work in math doesn't seem to overwhelm the student like the traditional pencil and paper approach. Students don't mind the prodding remarks of the computer ("Go on - give it a try" or "wake up") and chuckle when the smiley face acknowledges their correct answer. They also seem to appreciate the percentage scoring."

Many of the game programs produced by Tandy Corporation for Radio Shack are also quite satisfactory - probably because they are designed for a larger market and therefore received more careful programming.

We have literature on a series of tapes produced by Data Command Corporation which provide skill building exercises in the context of games. While we have not previewed these tapes, the concept is exactly in accordance with our perception of the types of computer lessons that would be most helpful for our student population.

G. The Environment

We have not been able to provide the kind of environment which would make the best use of the mini-computers for CAI. One reason for this is physical security. Because the danger of theft exists, each machine must be locked. One of the computers is in a secure room which can be locked at night, so it is kept relatively available. A cabinet has been constructed for one of the others. While it need not be disassembled when unattended, it must be arranged in its cabinet, covered, and padlocked. It is thus somewhat inconvenient to use. The third computer must be locked in a closet for safekeeping, and there-

fore must be assembled and then disassembled for each period of use. This makes it a nuisance at best. As each machine is in a separate location, no single person can monitor all three at one time. Because of complications in keeping track of the tapes, setting up the computers, and supervising their use, it cannot correctly be said that the machines reduce teacher loads or provide for more individual attention.

Another difficulty with the environment is the fact that the computers are located in areas where other activities are taking place. They both contribute and are subjected to unnecessary distractions.

IV. RECOMMENDATIONS

While we have not examined the effectiveness of the CAI program using a rigorous experimental design, we feel confident in our conclusion: The minicomputers provide a very useful adjunct to the EHRC educational design, but we are not yet realizing their full potential. The following steps are recommended.

A. Hardware

1. If possible, floppy disk drive units should be purchased to replace the cassette devices. This would provide more dependability, ease of use, and speed.
2. The Quick Printer has definite drawbacks. It is possible that it could be traded in towards an interface device that would allow it to be coupled with a printer used by the Data Processing Department. This possibility should be explored.

B. Software

1. The Data Command software described above should be previewed, and if satisfactory, several tapes purchased.
2. Additional copies of all existing tapes should be made for safekeeping.
3. All existing software should be cataloged, and at least one copy kept in a central library.
4. Some existing software is still in need of modification. Also, some software needs could be filled through inhouse programming.

C. Environment

Because Eagleville is now in a building and renovation phase, it is an excellent time to plan for a better environment for the machines. It is very important that all three computers be housed in one location that is appropriate for CAI.

1. The room itself should be secure, so that it can be locked up. This will make it unnecessary to frequently disassemble and reassemble the computers.
2. The room should be reserved for CAI and related activities only, to avoid causing or incurring distractions.
3. There should be separate work areas or study carrels for each minicomputer, and a desk for a monitor/assistant.
4. A complete catalog and software library should be contained in the CAI room.

D. Staffing

Currently teachers help students select tapes and often supervise using the machines. Every possibility should be explored to prevent teachers from being diverted from their main task -- providing individualized learning.

1. Perhaps volunteer workers could be solicited to staff the CAI room. This would not only free teachers, it would extend the hours when it is available. The potential for evening and weekend use should not be ignored.
2. Other members of the Eagleville staff could be trained to offer CAI during regular Seven-Day coverage duty.
3. The possibility of establishing a second level position at Eagleville to monitor and assist CAI should be carefully considered. If the right individual were found it would not only help the staffing situation, but would be an excellent vocational training experience.

MRW:aqw
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